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Ultra-High Energy Cosmic Rays in a Structured and Magnetized Universe Günter Sigl[a], Francesco Miniati[b], Torsten A. Enßlin[b] [a] GReCO, Institut d'Astrophysique de Paris, C.N.R.S., 98 bis boulevard Arago, F-75014 Paris, France

abstract We simulate propagation of cosmic ray nucleons above $10^{19}\,$eV in scenarios where both the source distribution and magnetic fields within about 50 Mpc from us are obtained from an unconstrained large scale structure simulation. We find that consistency of predicted sky distributions with current data above $4\times10^{19}\,$eV requires magnetic fields of $\simeq 0.1\mu$G in our immediate environment, and a nearby source density of $\sim 10^{-4}-10^{-3}\,\mathrm{Mpc}^{-3}$. Radio galaxies could provide the required sources, but only if both high and low-luminosity radio galaxies are very efficient cosmic ray accelerators. Moreover, at $\simeq 10^{19}\,$eV an additional isotropic flux component, presumably of cosmological origin, should dominate over the local flux component by about a factor three in order to explain the observed isotropy. This argues against the scenario in which local astrophysical sources of cosmic rays above $\simeq 10^{19}\,$eV reside in strongly magnetized ($B\simeq 0.1\mu$G) and structured intergalactic medium. Finally we discuss how future large scale full-sky detectors such as the Pierre Auger project will allow to put much more stringent constraints on source and magnetic field distributions.